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X-band UltraSAR Airborne Radar Description

This document describes MAXAR X-band airborne radar system for the purpose of obtaining an experimental FCC license for a DoD Test Range located at Dugway Proving Ground, UT.

System Description and Operational Area

This radar system supports ground imaging research and development using traditional synthetic aperture radar techniques. The sensor is to be located on an aircraft flying at a range of 10k ft to 16kft AGL altitude. The aircraft will operate within a 25-km radius of the Dugway Test Range located near 40° 10' N, 113° 04' W. The radar is to operate at this site for 2 weeks, twice per year, tentatively Apr and Jun of 2021. We would potentially repeat this over a 3-year period.

Antennas

The radar antennas are on a rotational pedestal mounted on the aircraft allowing the antennas to view the ground. The rotational pedestal can point the antennas at depression angles between 0 and 50 degrees below the aircraft horizon. The pedestal can point the antennas within 20 degrees of the side of the aircraft. The radiated signal will reach the ground at elevation angles between 10 to 50 degrees. The horizontal angle that the signal will reach the ground is dependent on the orientation of the aircraft. The signal can reach the ground over all azimuth headings.

There are separate transmit and receive antennas located next to each other. The antennas are custom designed. Transmit and receive antennas are identical. The gain of the antennas is 29 dBi at 10 GHz center frequency, and the antennas have a 5.2-degree half-power beam width in the horizontal plan and a 5.2-degree half-power beam width in the vertical plane. The antennas can operate in either vertical or horizontal polarization.

Waveform

The radar will use a pulsed linear-FM chirp or an arbitrary phase-modulated waveform. The waveform will be centered at 10.25 GHz and have a bandwidth of 4.0GMHz. Signals outside this bandwidth will be filtered and will be at least 50 dB below and desired signal. The waveform will have a maximum duty factor of 5%. The width of the waveform pulse will be approximately 20 microseconds and operate at a PRF of less than 4 kHz.

Transmit Power

The radar will transmit a waveform with a peak power of 3.5 kW. Factoring in the antenna gain, the peak ERP (effective radiated power; transmit power multiplied by antenna gain) is 1.34 MW peak. The radar will operate at a maximum of 5% duty factor, so the maximum average power emitted by the radar is 350 W, with an equivalent maximum average ERP of .067MW.